

Serial Number 09/120,874

Filing Date 14 July 1998

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19981106 049

1 Navy Case No. 78024

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3 BALLAST SYSTEM FOR UNDERWATER VEHICLE

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5 STATEMENT OF GOVERNMENT INTEREST

6 The invention described herein may be manufactured and used
7 by or for the Government of the United States of America for
8 governmental purposes without payment of any royalties thereon or
9 therefor.

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11 BACKGROUND OF THE INVENTION

12 (1) Field of the Invention

13 The present invention relates to a novel construction for a
14 ballast system for an underwater vehicle. More particularly, the
15 invention relates to an encapsulated ballast weight releasable
16 via a spring loaded bolt held in spring tension by a lanyard pin
17 and linear actuator.

18 (2) Description of the Prior Art

19 It is often desirable to allow an underwater vehicle to trim
20 its buoyancy as close as possible to a neutral buoyancy while
21 running its mission. It is often difficult to provide
22 controllability, safety and ease of slow-speed maneuvers by
23 trimming an underwater vehicle by means other than a ballast
24 weight system. By carrying a releasable ballast weight, the
25 vehicle may discard the ballast weight thereby becoming
26 positively buoyant and becoming capable of floating to the
27 surface of the water. After an underwater mission has been

1 completed and the ballast weight discarded, the buoyant vehicle
2 becomes more easily recoverable.

3 Prior ballast weight systems have used explosive-type
4 release mechanisms, such as squibs and explosive bolts. Although
5 relatively safe, explosive bolts present a danger to personnel
6 working with the underwater vehicle prior to its launch as well
7 as during and after its recovery if an unexploded bolt is still
8 present.

10 SUMMARY OF THE INVENTION

11 It is a general purpose and object of the present invention
12 to provide a releasable ballast weight that releases from an
13 underwater vehicle in a non-explosive manner.

14 It is another object of the present invention to provide a
15 ballast weight that is relatively compact in comparison to the
16 displacement of an underwater vehicle.

17 The invention is directed to a ballast weight system for
18 releasably attaching a ballast weight to an underwater vehicle.
19 The system includes a ballast weight, a housing disposed about
20 the ballast weight, a fairing connected to the ballast weight to
21 facilitate a flush connection of the ballast weight to the
22 underwater vehicle, a spring loaded bolt, a bolt coupler, and a
23 lanyard pin. The bolt coupler connects to the spring loaded bolt
24 at one end and at the other end the bolt coupler receives a
25 lanyard pin therethrough. A linear actuator is connected to the
26 lanyard pin. The lanyard pin is placed through the bolt coupler
27 and maintains the spring loaded bolt in spring tension. When the

lanyard pin is removed, the spring tension propels the ballast weight away from the underwater vehicle. The ballast weight is typically mounted on the bottom of the underwater vehicle, in this case spring energy and gravity propel the negatively buoyant ballast weight away from the vehicle.

BRIEF DESCRIPTION OF THE DRAWINGS

A more complete understanding of the invention and many of the attendant advantages thereto will be readily appreciated as the same becomes better understood by reference to the following detailed description when considered in conjunction with the accompanying drawings wherein:

FIG. 1 is a sectional end view of the components of the present invention.

FIG. 2 is a sectional side view of the components of the present invention of FIG. 1.

DESCRIPTION OF THE PREFERRED EMBODIMENT

The present invention generally comprises a ballast weight, a housing disposed about the ballast weight, a fairing connected to the ballast weight to facilitate a flush connection of the ballast weight to the underwater vehicle, a spring loaded bolt, a bolt coupler, and a lanyard pin.

Turning to FIGS. 1 and 2, the ballast weight system 10 comprises a weight 12 encapsulated in a housing 14, preferably of stainless steel and shaped in the form of a cylindrical cannister. The housing 14 is mounted by cap screws 20 in a

1 cylindrical underwater vehicle hull 11. The weight 12 is
2 preferably formed of tungsten, stainless steel or lead, though
3 other materials, preferably dense materials, may also serve as
4 the ballast weight. Optionally encapsulated within the weight 12
5 is a salt water activated pinger 16 that emits an acoustic signal
6 that may be received to indicate the location of the weight 12
7 thereby allowing easy retrieval of the detached weight. A
8 ballast weight cover or fairing 18 is also attached to the weight
9 12 to allow it to mount flush with the underwater vehicle 11.
10 The fairing 18 is connected by bolts or cap screws 21 to the
11 ballast weight 12. Fairing 18 has apertures therein allowing
12 access to housing mounting screws 20.

13 The weight 12 is attached to an underwater vehicle by the
14 spring loaded bolt 24, a bolt coupler 26, and a lanyard pin 28.
15 The bolt coupler 26 connects to the spring loaded bolt 24 at one
16 end and at the other end the bolt coupler 26 has a hole to
17 receive a lanyard pin 28 therethrough. A spring extender sleeve
18 27 maintains the spring 30 in position at one end. The spring 30
19 is shown in compressed position between extender sleeve 27 and
20 bolt 24. A linear actuator 32 (FIG. 2) is connected to the
21 lanyard pin 28. The lanyard pin 28 placed through the bolt
22 coupler 26 maintains the spring loaded bolt 24 in spring
23 compression. When the lanyard pin 28 is removed from the hole in
24 the bolt coupler 26, the compressed spring 30 propels the ballast
25 weight away from the underwater vehicle 11. The linear actuator
26 32 may be joined to a control device 40 such as an electronic

1 interface system which is in communication with an on-board
2 computer.

3 The ballast weight system may also include a buoy 36 having
4 a tether 38 joined to the weight 12 such that the weight may be
5 recovered from the surface of the water. The housing 14 and the
6 weight 12 define a chamber 34 in which buoy 36 is located until
7 weight 12 is discharged. Buoy 36 is typically a dumb bell shaped
8 float having tether 38 wrapped about the center of the buoy 36.
9 Tether 38 is anchored to the weight 12 at attachment point 42.
10 When the weight 12 is released, tether 38 unrolls from buoy 36
11 and prevents weight 12 from sinking. The spring extender sleeve
12 27, typically made from a plastic material, although other rigid
13 materials can be used, provides a solid core inside the chamber
14 34. This spring extender sleeve 27 keeps the tether and buoy
15 from fouling or tangling in the spring 30 coils.

16 When the underwater vehicle needs to be trimmed to a
17 positive buoyancy, such as at the end of operation or in an
18 emergency, the on-board computer releases the weight 12 via a
19 signal sent through an electronic interface system which causes
20 linear actuator 32 to release lanyard pin 28. The underwater
21 vehicle may then float to the surface of the water to be
22 retrieved.

23 Obviously, this invention could be modified to create a
24 device for trimming a vehicle to a negative buoyancy. In such an
25 embodiment, weight 12 could be a buoy positioned on an underwater
26 vehicle. Other structures can be adapted as necessary.

In light of the above, it is therefore understood that
the invention may be
practiced otherwise than as specifically described.

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3 BALLAST SYSTEM FOR UNDERWATER VEHICLE

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5 ABSTRACT OF THE DISCLOSURE

6 A ballast weight system for releasably attaching a ballast
7 weight to an underwater vehicle is disclosed where the system
8 comprises a ballast weight, a housing disposed about the ballast
9 weight, a fairing connected to the ballast weight to facilitate a
10 flush connection of the ballast weight to the underwater vehicle,
11 and a bolt coupler where one end of the bolt receives a lanyard
12 pin therethrough and the second end connects a spring loaded bolt
13 connected to the ballast weight. A linear actuator is connected
14 to the lanyard pin. The lanyard pin placed through the bolt
15 maintains the spring loaded bolt in spring compression such that
16 when the pin is removed, the spring compression propels the
17 ballast weight away from the housing.

